

**SPECIFICATION
FOR
SHEETING, RETROREFLECTIVE, FOR LICENSE PLATES
ENCLOSED LENS
(ANNUAL AND FIVE-YEAR ISSUES)**

(This specification is released for procurement purposes until revised or rescinded.)

SCOPE

This specification covers the materials, performance characteristics, quality, testing, and support services for preclear-coated retro reflective sheeting to produce finished license plates.

I. CLASSIFICATION

Reflective sheeting covered by this specification is classified as follows:

Class 1 - Multi-Year (5-Years)

Style 1 - Graphic
Style 2 - Plain

Class 2 - Annual

Style 2 - Plain

II. APPLICABLE STANDARDS

The following documents of issue in effect on the date of the Invitations for Bids shall form a part of this specification to the extend described in REQUIREMENTS.

ASTM D 4956-05 - Standard Specification for Retro-reflective Sheeting for Traffic Control

ASTM E 810-03 - Test Method for Coefficient of Retroreflection of Reflective sheeting.

ASTM G90-05 – Standard Practice for Performing Accelerated Outdoor Weathering of Nonmetallic Materials Using Concentrated Natural Sunlight.

ASTM E 1347-03 - Test Method for Color and Color Difference Measurement by Tristimulus (Filter) Colorimetry

ASTM E 308-01 - Test Method for Computing the Colors of Objects using the CIE System

ASTM E 805-01 - Practice for Identification of Instrumental Methods of Color or Color-Difference, Measurement of Materials

ASTM E 991-98 - Practice for Color Measurement of Fluorescent Specimens

American Society For Testing And Materials (ASTM)
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III. REQUIREMENTS

A. GENERAL REQUIREMENTS

1. Description

The retro reflective license plate shall consist of retroreflective (hereinafter referred to as "reflective" only) sheeting laminated to a specified metal substrate which is precleared then embossed by existing N.C. Dept. of Correction license plate processing equipment.

The reflective sheeting shall consist of lens elements enclosed within a transparent resin and shall have a precoated pressure sensitive adhesive backing protected by a removable liner. The license plate made of clear-coated reflective sheeting shall provide high visibility during both day and night, and a weather resistant, essentially smooth, flat outer surface when finished according to the sheeting manufacturer's recommendations.

Graphic designed reflective sheeting shall employ the design and colors on the background as mutually approved by the State and manufacturer of the reflective sheeting.

2. Prequalification

The reflective sheeting furnished under this specification shall be a product, which has successfully passed qualification tests, described herein, or shall have demonstrated a proven performance record of actual use by the State of North Carolina in the manufacture of license plates. The reflective sheeting furnished shall have been listed on, or approved for listing on, the Qualified Products List for Retro reflective Sheeting For License Plates as issued by the Division of Purchase and Contract.

Since some tests extend over a prolonged period of time and cannot be made after the material is applied to the plate substrate, prequalification testing shall be undertaken only for those sheeting's and finished plates which, in the opinion of the State appear to be of proper design as described by this specification. Test samples of license plate sheeting, and roll coat color, if required, shall be selected by the State at the designated delivery point, and shall be of representative production material of the type offered.

The exception to the above prequalification requirements is the Accelerated Outdoor Weathering Test. Material otherwise meeting the requirements specified herein will be accepted provided the sheeting has successfully passed all other tests herein and the manufacturer has successfully produced license plate sheeting material for at least one year. However, the State will use the Accelerated Outdoor Weathering Test as a quality assurance method during the production of license plates.

3. Periodic Evaluation

The State reserves the right to periodically evaluate the performance of materials. Samples for periodic evaluation of performance will be selected at random from

materials submitted on State Purchase Orders. Failure of materials to comply with the requirements of this specification shall be cause for rejection and removal from the Qualified Products List.

4. Color Processing

The sheeting shall permit color processing with compatible transparent and opaque process colors in accordance with the sheeting manufacturer's recommendation at temperatures between 60 to 100 degrees F and relative humidity at 20 to 80%.

5. Manufacturer's Identification Mark

For the purpose of warranty and the manufacturer's product identification, the sheeting shall be marked with an integral mark identifying the manufacturer and year-of-manufacture. The marks shall be fabricated as an integral part of the sheeting of all retro reflective license plate sheeting specified herein. The mark shall be inconspicuously placed so that a minimum of two (2) manufacturer's identification marks and a minimum of two (2) year-of-manufacture marks appear on a standard size (6"x12") license plate. They shall not interfere with the vital plate information and shall be visible to an inspector in diffused daylight and under illumination at night. The final design to be specified by the State. The supplier may vary the number and placement of ID marks for smaller size plates.

B. PERFORMANCE REQUIREMENTS

TABLE I

Minimum Coefficient of Retroreflection

Class	Observation Angle	Entrance Angle	Color White
1	0.2°	-4°	50
2	0.2°	-4°	35

TABLE II

COLOR SPECIFICATION LIMITS (DAYTIME)

Color	Chromaticity Coordinates		Luminance Factor (Y%)
	X	Y	
White	0.303	0.287	35 Min.
	0.368	0.353	
	0.340	0.380	
	0.274	0.316	

1. Coefficient of Retroreflection

The coefficient of retroreflection shall meet or exceed the minimum requirements of Table I when tested as specified in ASTM D4956 8.3.

After five (5) years, a clean license plate shall retain at least 50% of the minimum initial coefficient of retroreflection as shown in table 1, section B of this specification.

2. Daytime Color

The color of the sheeting shall conform to requirements of Table II when tested in accordance with ASTM D 4956 8.4. Daytime and nighttime color shall have substantially the same hue.

3. Artificial Weathering

The reflective sheeting shall be weather resistant and show no appreciable cracking, scaling, pitting, edge lifting, or curling, or more than 1/32" (0.8mm) shrinkage or expansion when tested as specified in ASTM D 4956 8.6.

Retroreflectivity measurements after artificial weathering (1,000 hours) shall be made only at 0.2 degrees observation and -4 degrees entrance angles. The sheeting, after artificial weathering shall have not less than 50% of the minimum coefficient of retroreflection as specified in Table I.

4. Colorfastness

After the specified artificial weathering the specimen shall conform to the requirements of Table II when tested in accordance with ASTM D 4956 8.4 and 8.7.

5. Shrinkage

The reflective sheeting shall not shrink in any dimension more than 1/32" (0.88mm) in 10 minutes or more than 1/8" (3.2mm) in 24 hours when tested in accordance with ASTM D 4956 8.8.

6. Flexibility

The sheeting shall be sufficiently flexible to show no cracking when tested in accordance with ASTM D 4956 8.9.

7. Liner Removal

The liner shall be easily removed without soaking in water or other solutions, and shall not break, tear, or remove adhesive from the sheeting when tested in accordance with ASTM D 4956 8.10.

8. Adhesion

When tested in accordance with ASTM D 4956 8.5, the adhesive backing of the sheeting shall produce a bond that will support a 1.75 lb. weight for 5 minutes, without the bond peeling for a distance of more than 2 inches (51mm).

9. Impact Resistance

The sheeting shall show no cracking or delaminating outside of the actual area of impact when subjected to the impact test in accordance with ASTM D 4956 8.11.

10. Specular Gloss

The sheeting shall have a specular gloss of not less than 40 when tested as specified in ASTM D 4956 8.12.

11. Accelerated Outdoors Weathering

Since actual weathering data from other regions of the world may not correlate with the climate of this State, finished license plate test panels shall be exposed at Raleigh, N.C., facing the equator and inclined at 45° from the vertical for 18 months (5 year plates) or 4 months (1 year plates). The license plate shall retain at least 80% of the minimum Coefficient of Retroreflection specified in Section III.B, Table I. when measured at 0.2° observation and -4° entrance angles and shall exhibit no crazing, cracking, peeling, loss of the message coating or significant change in color of the message coating or other evidence of degradation.

IV. WARRANTY

The manufacturer warrants to the State that all materials furnished under this specification will be new, of good components and workmanship and agrees to replace promptly any materials that fail when tested as specified herein, or when used as intended (following production methods as approved by the sheeting manufacturer), free of negligence or accident, for a minimum period of one year for the annual and five years for the multi-year license plates from the date the sheeting is affixed to the license plate (this is in addition to a maximum of one (1) year shelf storage of the roll). Such replacement shall include all costs associated with the recall, production, and distribution of the finished license plates.

V. SERVICE, PARTS, AND MANUALS

The reflective sheeting supplier shall, without additional cost, provide the license plate manufacturing shop with competent technical service and product information until the shop operating personnel are able to manufacture quality license plates in accordance with the State's requirements. A list of the technical service personnel and their qualifications shall be provided to the State.

To ensure continued quality license plate manufacture, the sheeting supplier shall, without additional cost, provide the State license plate manufacturing facility with on-site technical service related to products supplied. Emergency on-site technical service shall, without additional cost be available within 48 hours of notification by the manufacturing shop of reflective sheeting production difficulties.

VI. ACCEPTANCE EVALUATION AND QUALITY ASSURANCE

All sheeting furnished under this specification shall pass all of the following tests as required by ASTM D 4956-90:

<u>TEST</u>	<u>TEST DESCRIPTION</u>	<u>REQUIREMENT</u>	<u>METHOD</u>
1	Coefficient of Retroreflection, Initial	D 4956 8.3	ASTM E 810
2	Coefficient of Retroreflection, after Accelerated Weathering	D 4956 8.6	ASTM E 810
3	Color, Daytime	D 4956 8.4	ASTM E 1347
4	Accelerated Weathering	D 4956 8.6	ASTM G 90
5	Colorfastness	D 4956 8.7	ASTM E 1347
6	Shrinkage	D 4956 7.6	D 4956 8.8
7	Flexibility	D 4956 7.7	D 4956 8.9
8	Liner Removal	D 4956 7.8	D 4956 8.10
9	Adhesion	D 4956 7.9	D 4956 8.5
10	Impact Resistance	D 4956 7.10	D 4956 8.11
11	Specular Gloss	D 4956 7.11	D 4956 8.12

Prospective bidders are required to furnish independently certified test results of the above tests to this office. In lieu of the above test results, the applicable LS 300C or ISO 7591 test results are acceptable, or the sheeting offered shall have demonstrated a proven performance record of actual use by the State of North Carolina in the manufacture of license plates.

VII. DELIVERY AND PAYMENT

Delivery of and payment for materials under this specification shall be in accordance with the terms and conditions of the Invitation for Bids. The contractor shall be responsible for any packing, packaging, or protection required to insure delivery in an undamaged condition.

VIII. ORDERING DATA (For Purchase & Contract Use Only)

Purchasers may exercise any desired option offered herein and should specify the following in the Requisition and Invitation For Bids:

1. Title, number and date of this specification
2. The Class and Style of sheeting desired

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